

Lower Murray Newsletter

Issue 2 – December 2019

Welcome to Issue 2 of the Lower Murray newsletter. In this issue we will bring updates of our monitoring and outcomes of Commonwealth environmental water delivery in the Lower Murray system.

Project updates

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Photo: Stream metabolism site - Downstream of Lock 6

- Our oxygen loggers continue to collect time series data from sites below Locks 1, 4 and 6. Since deployment, in September 2019, our field sampling team has been downloading the data fortnightly, while collecting regular water and zooplankton (microinvertebrates) samples to find out how productive the food webs are in the Lower Murray.

- Downstream of Lock 4, targeted sampling for zooplankton has been conducted fortnightly since early October in both pelagic (water column) and littoral (shoreline) zones for molecular analyses. This will inform the research project focusing on food webs. Basal food resources, such as phytoplankton (seston), submerged and emergent macrophytes, terrestrial leaf litter and biofilms were collected in early November. These samples will be analysed to investigate how productivity, mediated by flow, enhances Murray cod recruitment.



Photos (left to right): 1. Zooplankton being pumped from the littoral zone. 2. Haney trap being used to collect zooplankton from the water column

- Our first sampling trip targeting Murray cod larvae below Locks 3 and 4 occurred in November 2019. A combination of techniques were used, including light traps, drift and bongo tow nets. Murray cod larvae have been identified and samples have been stored for further processing (ageing, gut content and tissue analyses). The next sampling trip is planned to occur in early January, aiming to collect early juvenile Murray cod.



Photo: Light trap used for Murray cod larvae sampling.

- The first vegetation trip occurred in December 2019. Assessment of littoral vegetation was conducted downstream of Locks 1 and 6. Sampling took place in tailwaters of weirs as small increases in water discharge can result in larger littoral areas inundated in these reaches compared to the downstream end of weir pools.



Photo: SARDI staff sampling in littoral zone.

- So far 44 pouched lamprey and 13 short-headed lamprey have been caught and PIT tagged by our fish team. Monitoring found that these amazing species have travelled as far as Lock 8 – 726 Km (pouched lamprey) and to Lock 10 - 825 km (short-head lamprey).



Photo: Sardi staff holding a pouched lamprey



Photo: Aerial view of the Coorong, Murray mouth and Southern Ocean. (photo supplied by Department for Environment and Water)

Contribution of environmental water to salt export

The Murray River is very important as it drains a large area of Australia, from southern Queensland to South Australia passing by New South Wales and most of inland Victoria. The Mighty Murray is the world's 16th longest river (2,250 km) and the 3rd longest navigable river, after Amazon and Nile Rivers. Whilst it is lengthy, the Murray River has been considered a slow flow system, even pre European settlement. In the late 1800s an irrigation system was introduced, followed by construction of storages, locks and weirs in the earlier 1900s. These, coupled with climate

change and more drastic and frequent droughts have considerably diminished the amount of natural flow reaching the Southern Ocean via the Murray Mouth.

By modifying flow regime, rivers can have their chemical, physical, geological and biological processes altered. For example, reduced flows will increase the intrusion of salt and decrease the export of salt from the system. There is approximately one trillion tonnes of salt in groundwater in the Murray–Darling Basin (MDB) and an additional 1.5 million tonnes is deposited in the basin each year by rainfall. Unless salt is exported from the basin with flow, there will be a net accumulation of salt within the basin. The Basin Plan sets out a salt export objective to ensure adequate flushing of salt from the Murray River system into the Southern Ocean. The indicative target for salt export from the basin is two million tonnes per year.

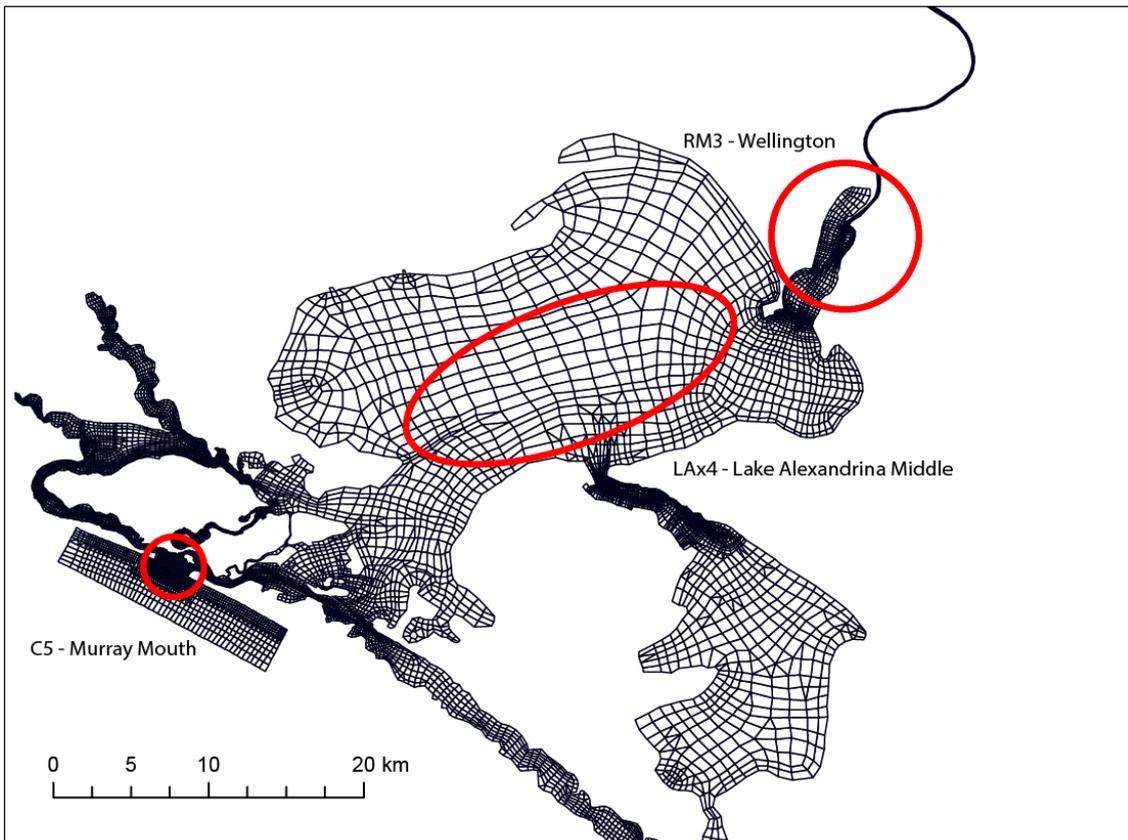


Image: Modelled cells (circled) used for calculating the modelled concentration of salt at the Wellington, Lake Alexandrina Middle and Murray Mouth sites.

Being at the end of the MDB, salt accumulates rapidly in the Lower Lakes, Coorong and Murray Mouth (LLCMM) during low freshwater flow. River flows, therefore, can influence the concentration and transport/export of salt. Environmental flows can be used to reinstate some of the rivers natural processes, which could provide ecological benefits by improving habitat and resources provisions for aquatic biota. To assess the contribution of environmental water to salt transport for the last five years (2014-15 to 2018-19), a hydrodynamic-biogeochemical model was applied below Lock 1 to the Murray Mouth. The model was validated with water quality data. The aim was to answer the following question:

Would environmental flows increase the mobilisation of salts from the Basin and increase the transport/export of salt passing from Lock 1 through the Lower Murray River and ultimately through the Lower Lakes and Murray Mouth?

Flow was relatively low in four of the last five years. Nonetheless, the results showed that environmental water increased salt export over the barrages during the five-year period of monitoring. Particularly, during the low flow years (2014-15, 2015-16, 2017-18 and 2018-19), where environmental water accounted for 64–100% of all salt export. Flow over the barrages plays a key role in preventing or reducing seawater and salt from coming through the Murray Mouth into the Coorong.

Over five years, environmental flow contributed to

1,268,000 tonnes



of salt export to the Southern Ocean. This is equivalent of 63,400 semi-trailers each carrying a full load of salt (~ 20 tonnes).

Overall, CEW water contributed to 84% of the salt export facilitated by environmental water.

Murray cod larvae sampling

Murray cod has great recreational and cultural significance in the Murray Darling Basin. Even so, populations have declined as result of changes in flow regimes, barrier to movement, overharvesting and habitat degradation. In the lower River Murray (downstream of the Darling River junction), the fragmentation of the river by weirs, alteration to hydraulics and loss of fast flowing habitats are the main threats to the persistence of Murray cod populations.

Whilst Murray cod spawn annually (October–December) irrespective of flow, recruitment in the lower Murray River main channel is positively associated with flow. Over the past five years, juvenile Murray cod have been found in the main channel of the Lower Murray River via the Long-Term Intervention Monitoring Riverine hydraulics and productivity are likely related to survival of early life stages, reflecting in recruitment and abundance. Likewise, survival is influenced by enhance growth and body condition. Commonwealth environmental water has been delivered to the Lower Murray

to improve flowing water habitat and enhance riverine productivity. This could improve Murray cod recruitment in this region.

As part of the MER project, we will explore the mechanisms influencing Murray cod recruitment, in association with the proposed research project, by assessing aspects of Murray cod recruitment (e.g. abundance, growth, condition) in association with flow. Understanding the magnitude of recruitment, and causal links between recruitment and flow, are critical for informing future environmental flow management and will help evaluate ecological outcomes of Commonwealth environmental water.

The first targeted sampling of Murray cod larvae for this project occurred in November 2019. Samples have already been sorted and some Murray cod larvae have been found. Our team will continue sampling looking for early stage juvenile Murray cod during January and March, and new recruits in May, before measuring growth rates and assessing morphometric condition. In addition, basal food resources, such as phytoplankton (seston), submerged and emergent macrophytes, terrestrial leaf litter and biofilms will assist informing how productivity, mediated by flow, enhances Murray cod recruitment.



Photos (clockwise): 1. Light trap in the water sampling for Murray cod. 2. Transferring and preserving larval sample. 3. SARDI vessel Tandanus towing bongo net. 4. Murray cod larvae collected with light trap. 5. SARDI staff washing off drift net samples.

Engagement and communications plan

Good news!!! An engagement and communications (E&C) plan for the CEWO Monitoring, Evaluation and Research (MER) in the Lower Murray has been developed for the coming year (December 2019 to December 2020). This will guide us to undertake additional activities to better communicate findings and exchange knowledge with stakeholders and interested groups, including First Nations and recreational fishing communities. Such activities include to:

1. Develop a website specific for the Lower Murray area as well as other hard copy materials with information about the MER project, monitoring and researches;
2. Participate in a capacity building workshop, in which powerful communication tools/ techniques will be learnt;
3. Connect/consult with key First Nations representatives in order to better understand their cultural values and objectives. This will also provide the opportunity for key First Nations peoples to learn about the MER

project, environmental watering and influences on the Lower Murray. Ultimately, we will explore/discuss opportunities for joint ventures;

4. Consult and better engage with recreational fishing communities to inform about MER project, environmental watering and influences on the Lower Murray. We will explore and discuss opportunities for joint targeted activities during the future years of MER; and
5. Attend MER Practitioners Forum and contribute to discussions around adaptive management and environmental water planning.

We strongly believe these initiatives will assist in communicating our findings, learning about First Nations/cultural perspective and exchanging knowledge with recreational fishers and other interested groups as well as with the broad community.



Photo: Consultation with the Inland Water recreational fishing representative of Recreational Fishing Advisory Council (Peter Teakle)

Lower Murray Selected Area Working Group

The MER Selected Area Working Group (SAWG) has been established to provide a forum for the exchange of information and knowledge that supports the implementation of the MER Project. It involves the core project team members and representatives from agencies directly or indirectly involved in environmental water planning and delivery to the Lower Murray. The Working Group is important to provide a general support and advisory role for MER Project.

In effect, the Working Group is to facilitate coordination between environmental water delivery partners and communicate any information that could translate to improvements in water delivery, and relevant monitoring and evaluation projects. In addition, the Working Group is to exchange information to improve the implementation of the MER Project and assist in identifying and managing issues, risks and opportunities relevant to the MER Project.

Please meet the Working Group Members from respective agencies. They all have been fundamental in the conception, implementation and advancement of the MER Project.

Agency	Name
SARDI	<p>Qifeng Ye (SAWG chair and Project Leader – MER Lower Murray)</p> <p>George Giatas (Project officer – MER Lower Murray)</p> <p>Chris Bice (Task Leader - Fish (Channel), Flow-cued Spawning Fish Recruitment and Murray Cod Recruitment)</p> <p>Jason Nicol (Task Leader - Littoral Vegetation Diversity and Productivity)</p> <p>Luciana Bucater (MER Engagement and Communication Officer)</p>
University of Adelaide	<p>Rod Oliver (Task Leader – Stream Metabolism and Water Quality)</p> <p>Deborah Furst (Task Leader – Microinvertebrate Assemblage)</p> <p>Justin Brookes (Task Leader – Task Leader – Matter Transport and Coorong Habitat)</p>
University of Adelaide/DEW	<p>Matt Gibbs (Task Leader – Hydrology (Channel) and Hydraulic Regime)</p>
CEWO	<p>Anthony Moore (MER Project Contact)</p> <p>Alana Wilkes (Southern Basin Delivery)</p> <p>Michelle Campbell (Local Engagement Officer)</p>
MDBA	<p>Janet Pritchard/Gill Whiting/Andrew Lowes/Adam Slugget (SCBEWC and The Living Murray Initiative, Environmental Management Division)</p> <p>Jacqui Hickey/Damian Green/Tom Zouch (River Murray Operations)</p>
DEW	<p>Michelle Bald /Rebecca Quin (Lower Murray Selected Area consortium partner)</p> <p>Tony Herbert /Jan Whittle (Lower Murray Selected Area consortium partner)</p> <p>Tracey Steggles (Lower Murray Selected Area consortium partner)</p> <p>Jarrod Eaton (Lower Murray Selected Area consortium partner)</p> <p>Tumi Bjornsson/Andrew Rettig (Lower Murray Selected Area consortium partner)</p>
DEW/SAMDB NRMB	<p>Darren Willis/Rebecca Turner</p>
PIRSA Fisheries and Aquaculture	<p>Keith Rowling</p>
SA Water	<p>Gary Fyfe</p>

What's next?

The team is working on completing, by March, a long-term report that evaluates the ecological responses to Commonwealth environmental water delivery to the Lower Murray from 2014-15 to 2018-19 as part of the CEWO Long-Term Intervention Monitoring Project.

The end-of-project workshop is being planned in consultation with water managers, local community and scientists, which will be held after the release of project final report to disseminate our findings and learnings.

We will continue to monitor the dissolved oxygen concentrations in the Lower Murray and collect

fortnightly water quality data until late February. We will collect zooplankton (pelagic/littoral sampling) fortnightly until mid-January. Our fish team will be out sampling for early juvenile Murray cod from January through to March using light traps, bongo tows and electrofishing. Laboratory processing of these fish in the proceeding months will include ageing, gut content and tissue analyses.

Fish assemblage data following a mandatory Basin-wide protocol will be collected in April to inform the Basin evaluation of Commonwealth environmental water on fish assemblages.

Our modellers will continuously download data and test models to inform the hydraulic regime and matter transport components.



Photo: River red gum (*Eucalyptus camaldulensis*) seedling on a sandbar downstream of Lock 4, inundated by the flow pulse provided by commonwealth environmental water.



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